

the branchlets) is one of the Section *Plurinerves*, related to the '*A. sulcata* group' (*A. sulcata*, *A. brachyphylla*, *A. dura*, *A. nitidula*, *A. tetanophylla* and two undescribed species from southern Western Australia). It differs from all the other members of the group, except *A. tetanophylla*, by its cuspidate-pungent phyllodes. *Acacia tetanophylla* is readily distinguished from the new species by its longer, 6- or 7-nerved phyllodes; moreover, it is a 1-2 m, erect shrub. *A. declinata* is also similar in general appearance to *A. retrorsa* in its small, retrorse phyllodes and prostrate habit; however, the latter has 5-nerved phyllodes, striate branchlets and it is found in the area west and north of Badgingarra, far northwest of the range of the new species.

#### ACKNOWLEDGEMENTS

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#### REFERENCE

BRIGGS, J. & LEIGH, J. 1988 "Rare or Threatened Australian Plants. 1988 Revised Edition." Special Publication No. 14. (Australian National Parks and Wildlife Service: Canberra.).

### THE TERRESTRIAL VERTEBRATE FAUNA OF THE TORNDIRRUP NATIONAL PARK

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#### INTRODUCTION

The Torndirrup National Park is situated on the peninsula south of Princess Royal Harbour and King George Sound at Albany on the south coast of Western Australia. The area was gazetted as a Reserve in 1918 but not named until 1969 when it came under control of the National Parks Board. This narrow and relatively small Park is about 20 km from east to west, of some 3,800 hectares (Figure 1). It is one of the two southernmost National Parks in Western Australia, with West Cape Howe National Park further west. No fauna surveys had apparently been carried out prior to this one which commenced in 1986 with encouragement from the staff of the Department of Conservation and Land Management (CALM), Albany.

The plutonic rocks of the rugged peninsula are porphyritic granitoid, in places intruding into gneiss and overlaid by Pleistocene deposits of limestone (Muhling & Brakel, 1982). Some limestone later eroded away exposing monadnocks or granite outcrops, particularly in the central third of the Park where most of this survey was carried out. Impoverished sands cover most of the Park. Water tends to lie in many low-lying areas during the winter but there is no permanent surface water, though moist areas occur in hollows or around rock outcrops.

G.J. Keighery (1988, pers. comm.) includes at least 450 species in an interim list of plants in the Park. There is unusual diversity for such a small coastal park. Predominant over the trapping areas during this survey were sedges and sword grass, *Lepidosperma* species, which formed a dense undergrowth. Dryandras, seven species of Banksias (four of which occurred mainly in the central third), Peppermints (over limestone), Christmas

Trees, Eucalypts, *Adenanthos* and *Melaleuca* species were patchily distributed forming in parts almost impenetrable thickets. Many plants have been pruned by fire, animals or wind. A devastating fire occurred through the central part of the park in March 1969 (Albany Advertiser); roadside firebreaks have since been burnt regularly. Small areas of 'dieback' (*Phytophthora cinnamomi* infection) were present.

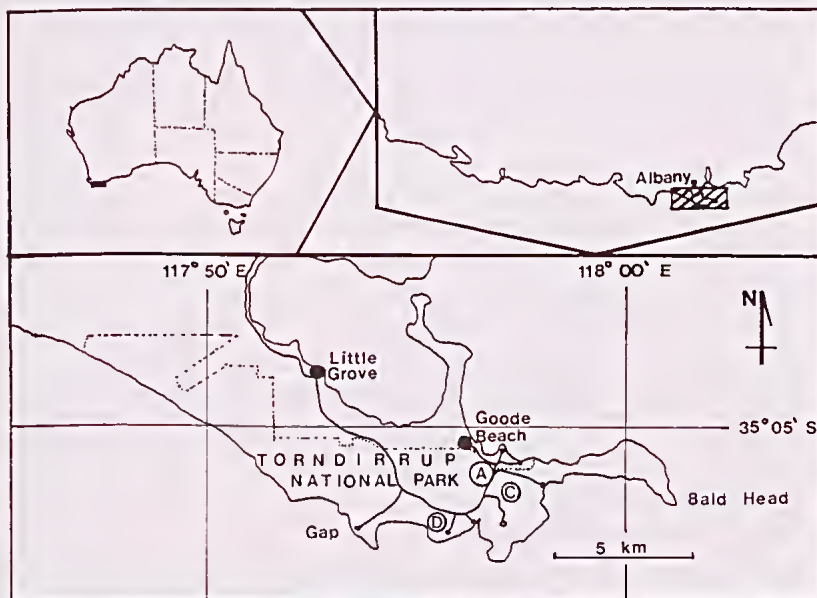


Figure 1. The location of Torndirrup National Park, showing study sites A, C and D. Sites B, E, F, G and H are within 1 kilometre of Site A.

## STUDY SITES AND METHODS

Each study site (Figure 1) had the following vegetation and features:

**Site A:** The northern edge of about 50 hectares of sandy heath, generally sloping to the north-east, with *Banksia attenuata* the predominant banksia. The trap site was burnt in July 1979, but the dense undergrowth had regenerated well.

**Site B:** Four hectares of stunted Karri, Marri and Peppermint in a saddle between two rocky outcrops.

**Site C:** A 7 hectare grove of very old, well established trees, predominantly *Banksia littoralis* and *Agonis flexuosa*.

**Site D:** the north-eastern edge of some 170 hectares of low banksia-sparse heath burnt in March 1982; the regrowth was generally less than a metre in height.

**Site E:** Similar heath to Site A but not burnt for many years and therefore denser.

**Site F:** On a limestone ridge in a patch of *Agonis flexuosa* which was burnt for fire control during the winter of 1987.

**Site G:** Predominantly *Banksia quercifolia* heath, with some *Banksia attenuata*.

**Site H:** Edge of *Banksia quercifolia* heath.

In 1986 pit traps were installed in the first four sites (A-D). Sites C and D were closed permanently in April 1988. After January 1988, further pit traps were installed in the remaining sites (E-H), with drift fences.

Sections of plastic pipe 60 cm long and 13 cm or 16 cm in diameter were used, the bottom closed with aluminium fly-wire. Six to 10 traps, at approximately 10 metre spacings, were set at each site. Drift fences of either plastic Gutter-Guard (held upright by short lengths of wire) or flywire were used at some sites. Each trap was identified by a letter or number. The traps were opened for a few days at intervals throughout the year, except during the winters of 1986 and 1987 when the author was overseas: During the winter of 1988, some sites were operated continuously for several weeks at a time.

From April 1988 up to 50 Elliott Traps (9 x 10 x 33 cm), baited with bacon or a muesli/honey/peanut butter mixture, were used along fire-breaks and tracks beneath vegetation in the vicinity of most sites.

From June 1988 a cat trap (50 x 50 x 100 cm), baited with chicken or rabbit, was set in the vicinity of Sites B, G and H.

When open, all traps were inspected every morning: Mammals were identified, sexed (except *Muridae*), aged, weighed (smaller species only) and most were marked on the under surface of the tail base with a black indelible pen; retraps were identified by blue or red. Nose/chin swabs were taken from some *Tarsipes rostratus* for later pollen examination. Reptiles and amphibians were only identified and aged. Ants were repelled with 'Bitefree' (Pea-Beau) around the traps.

All captures were released where caught, unless there was need for a second opinion on identification, in which case they were released later where trapped.

When adequate numbers of any species were obtained, the numbers caught at each site, and overall, during a given period were calculated per 100 trapnights ( $t/n$ ) to give some measure of their abundance throughout the year. Where there were less than 100  $t/n$  in any period at a site, a projected density was calculated by applying the formula:  $(N \times 100) \div t/n$ , where  $N$  = Numbers trapped during that period.

To complement the findings derived from the trapping programme, visual observations and the examination and identification of road-kills, particularly reptiles, have been included, as were also some observations made where the author resides at Goode Beach on the central northern park boundary.

At the eight sites, from May 1986 to December 1988, the pits were open a total of 8088 trapnights; The Elliott traps were open a total of 5340 trapnights.

Table 1. Total numbers (Column 1) of each species trapped (+) in pit-traps, Elliott traps or a cat trap in the vicinity of each sampling site. Sightings (S) are recorded, but not included in total numbers. WAM Accession Numbers refer to specimens submitted during the present survey.

SPECIES	Total	Sampling Sites								WAM Accession
	Nos	A	B	C	D	E	F	G+H	Numbers	
<b>MAMMALS</b>										
<i>DASYURIDAE</i>										
<i>Antechinus flavipes</i>	2		+							M28675
<i>Parantechinus apicalis</i>	3	+								M28674
<i>Sminthopsis griseoventer</i>	92	+	+	+	+	+	+	+		M29097; M29128-9



SPECIES	Total Nos	Sampling Sites							WAM Accession Numbers
		A	B	C	D	E	F	G+H	
<b>MACROPODIDAE</b>									
<i>Macropus fuliginosus</i>		S		S	S		S	S	
<b>PERAMELIDAE</b>									
<i>Isoodon obesulus</i>	26	+	+	+		+		+	
<b>TARSIPEDIDAE</b>									
<i>Tarsipes rostratus</i>	428	+	+	+	+	+	+	+	
<b>MURIDAE</b>									
<i>Mus musculus</i>	7			+	+	+	+	+	
<i>Rattus fuscipes</i>	285	+	+	+	+	+	+	+	M29098; M29099
<i>Rattus rattus</i>	7	+	+		+				
<b>CANIDAE</b>									
<i>Vulpes vulpes</i>		S	S		S				
<b>FELIDAE</b>									
<i>Felis catus</i>		S	S						
<b>LEPORIDAE</b>									
<i>Oryctolagus cuniculus</i>		S	S		S		S		
<b>AMPHIBIA</b>									
<b>LEPTODACTYLIDAE</b>									
<i>Crinia georgiana</i>	31	+	+	+		+	+	+	
<i>Helioporus eyrei</i>	34		30			+	+	+	
<i>Limnodynastes dorsalis</i>	16		+	+			10	+	
<b>HYLIDAE</b>									
<i>Litoria adelaidensis</i>	5		+			+		+	
<i>Litoria moorei</i>	2		+						
<b>REPTILES</b>									
<b>GEKKONIDAE</b>									
<i>Phyllodactylus marmoratus</i>			S		S				
<b>PYGOPODIDAE</b>									
<i>Aprasia striolata</i>	5	+				+	+	+	R100249
<i>Pygopus lepidopodus</i>	6	S			S	+		+	R100322
<b>SCINCIDAE</b>									
<i>Ctenotus catenifer</i>	32	+			+	+		+	
<i>Ctenotus labillardieri</i>	1				+				
<i>Egernia luctuosa</i>	4	+				+		+	
<i>Egernia kingii</i>	1		+						
<i>Egernia napoleonis</i>		S							R100324
<i>Hemiergis peronii</i>	31	+	+	+		+	+	+	R100321
<i>Leiolopisma trilineatum</i>	45	+	+	+	+	+	+	+	R100319
<i>Lerista microtis</i>	39	+	+		+	+	+	+	R100323
<i>Sphenomorphus australis</i>	12					+		+	R100320
<i>Tiliqua rugosa</i>	22	+		+	S	S	+	+	
<b>VARANIDAE</b>									
<i>Varanus rosenbergi</i>	2	S	+			+		S	
<b>BOIDAE</b>									
<i>Morelia spilota</i>		S		S				S	R98118
<b>ELAPIDAE</b>									
<i>Notechis coronatus</i>	7			S	S	+		+	
<i>Notechis curtus</i>	1	S				+		S	R94801
<i>Notechis scutatus</i>	6		+			+	+	+	
<i>Pseudonaja affinis</i>					S		S		

A B C D E F G+H

## RESULTS AND DISCUSSION

The numbers of vertebrate fauna recorded during this survey and the sites where trapped or seen are shown in Table 1. Eight species of mammal

(including two introduced species) were trapped; four other species were sighted; a further two species were recently reported. Five frog species and 15 reptile species were trapped; four others were sighted or identified from road kills. Inadvertent captures included a Common Bronzewing and two Brown Quail chicks in pit traps and several Ravens in the cat trap.

Western Australian Museum (WAM) records show that, in the Albany area, the Quokka *Setonix brachyurus* was last collected in 1905 (on the Park boundary), and the Woylie *Bettongia penicillata* in 1933. The Ringtailed Possum *Pseudocheinus occidentalis* is still seen near Albany; four Museum specimens were collected during the past seven years but this species was not seen in the Park recently. An adult male Brush-tailed Phascogale *Phascogale tapoatafa* (WAM M24617) was killed recently on the road at the Park entrance where there is tall timber. The habitat is probably unsuitable for this arboreal species within the Park. Specimens of *Notechis minor* (WAM R15098) and *Rhinoplocephalus bicolor* (WAM R81349) were collected southwest of Albany near the Park boundary, but were not seen or trapped in the Park during this survey.

Christensen and others (1985) carried out an extensive fauna survey of the southern forests of Western Australia. The species recorded in their Zone I, which included all their south coastal surveys in the coolest and wettest part, approximate to those recorded here: However *Morelia spilota* and *Notechis curtus* were absent from their Zone I. Also in this survey *Tarsipes rostratus* exceeded *Rattus fuscipes* in abundance.

In a survey of coastal areas between Busselton and Albany, How and others (1987) showed that most mammalian populations were small and isolated. They recorded another 11 species of terrestrial vertebrates (8 reptiles and 3 frogs) from the Albany area within the past 40 years, but these were not seen or trapped during this survey. Neither survey recorded the Dibbler.

The following general observations were made on trapping efficiency; breeding and weight variations; population densities through the year.

## MAMMALS

### DASYURIDAE

#### *Antechinus flavipes* Yellow-footed Antechinus

A juvenile male weighing 23.5 g was trapped in October 1986. An adult male weighing 34 g was trapped in August 1988.

#### *Parantechinus apicalis* Dibbler

An adult male weighing 77 g was trapped in December 1987 in the same trap as the tail and fur of an adult honey possum *Tarsipes rostratus*. An adult male weighing 76 g and in non-breeding condition, was trapped in mid-June 1988. An adult female weighing 57 g was trapped (same pit as the second Dibbler) in mid-September 1988 with the pouch contracted but having recently weaned young (Woolley, 1971). This individual was found dead six days later during a period of very inclement weather in an Elliott trap 200 metres from where it was released.

The weights are heavier than those of the same species on Boullanger Island north of Perth (Dr Chris Dickman — pers. comm.).

#### *Sminthopsis griseoventer*. Coastal Dunnart

Adult males weighed 17.5-32 g; females weighed 13.5-20 g. Three females with pouched young (<5 mm in size; number undetermined) were

trapped during second half of September. Three lactating females (one of them WAM M29097) were trapped in November and December.

The overall trapping density was generally less than 2 per 100 t/n, with the following exceptions:

During August 1988 nine adults with luxuriant fur (all heavy males, one weighing 32 g) were trapped during 186 t/n in one year regrowth. In early winter five adults were trapped during 84 t/n; in spring three adults were trapped during 72 t/n.

In December several young ones, weighing less than 10 g, were trapped and often retrapped, the highest trapping densities being 14 per 100 t/n in 1987 and 8 per 100 t/n in 1988.

## MACROPODIDAE

*Macropus fuliginosus* Western Grey Kangaroo

Individuals or small groups were sighted throughout the Park, being more readily seen in burnt areas feeding on new growth or during warm evenings in spring and summer on roadsides; several were killed by vehicles. Apparently more abundant in the less disturbed western part of the Park along the coastal escarpment. One group regularly grazed on a lawn in Goode Beach. Young in the pouch were seen during spring.

*Macropus ima* Western Brush Wallaby

Recent sightings (Martin Lloyd/Geoff Harnett; pers. comm.) in the western end of the Park along the coastal escarpment.

## PERAMELIDAE

*Isodon obesulus* Southern Brown Bandicoot

Nine juveniles were trapped in pits during October to February. Fourteen (7 juveniles; 7 adults) were trapped in Elliotts during April to November. Three were caught in the cat trap during September/October: one female had pouched young, approximately 10 mm long, in mid-October and was recaptured in a pit two days later, 150 metres away.

## TARSIPEDIDAE

*Tarsipes rostratus* Honey Possum

Males weighed up to 13.5 g and females up to 22.5 g. Overall densities exceeded 10 per 100 t/n whenever there was plenty of banksia flower. A maximum trapping density of 36 per 100 t/n was recorded during December 1986, when *Banksia attenuata* was in bloom — this included nine honey possums in one pit trap one night. This marsupial was abundant in the Park, though seemingly subject to quite spectacular fluctuations in population throughout the year as recorded elsewhere (Wooller and others, 1981). More likely they are constantly moving into freshly-flowering areas.

Females weighing from 10-22.5 g, with obvious young in the pouch, were trapped throughout the year, as were juveniles out of the pouch, weighing 3-6 g. Highest densities of juveniles were recorded during October/December in *Banksia attenuata* (10 to 50 per 100 t/n), during January and March in *Banksia littoralis* (12 per 100 t/n) and during winter in *Banksia quercifolia* (20 to 22 per 100 t/n). Juveniles of both sexes were retrapped at the same site during autumn, winter and spring. In this area honey possums



also breed throughout the year as elsewhere (Scarlett & Woolley, 1980; Renfree and others, 1984).

The overall ratio of adult males to females was about even (163 : 160). At some periods, however, there was considerable disparity:

Males outnumbered females in *B. attenuata* during December 1986 (10M : 1F); during January/February 1988 (15M : 8F) and October to December 1988 (21M : 10F), and in *B. quercifolia* during May to July 1988 (21M : 12F). By contrast females outnumbered males in *B. attenuata* during March 1987 (6F : 3M) and in *B. quercifolia* during September 1988 (37F : 20M), suggesting females lingered when flowering had almost finished.

In pit traps this species is particularly vulnerable; individuals have been killed and generally eaten by *Rattus fuscipes*, *Parantechinus apicalis*, *Sminthopsis griseoventer* and *Notechis scutatus*. One mature female with two hairless pouched young was found dead in a trap with a frog (See *Heleioporus eyrei*). Three retrapped young died.

## MURIDAE

*Mus domesticus* House Mouse

Sporadically trapped though four in March/April 1987. One was eaten by a Tiger Snake in same pit.

*Rattus fuscipes* Southern Bushrat

Forty-eight were trapped in pits at all sites; 237 were also caught in Elliotts in all areas (open heath, dense bush and up trees and logs), even in the wettest and coldest conditions. Twelve caught in Elliotts during the winter were dead and emaciated. Half-grown juveniles were most frequently trapped in spring and early summer.

*Rattus rattus* Black Rat

A few were caught in pits, particularly near Goode Beach during summer.

*Capra hircus* Goat

Abundant fresh scats and some tracks apparently of this species were seen at the western end of the Park along the coastal escarpment.

*Vulpes vulpes* Fox

Sporadically seen; a male was killed on the Goode Beach road: two cubs were seen frequently and the remains of one were found in December 1987.

*Felis catus* Cat

Sporadically seen, generally domestic ones straying from Goode Beach or Frenchman Bay. Several were trapped by the ranger at fishing haunts where they create a nuisance, stealing bait or catches; the stomachs of two contained only fish remnants.

## AMPHIBIA

Frogs were generally only trapped between April and November.

*Helioporus eyrei*

Thirty were trapped in forest at Site B, one as late as December. A female honey possum in a pit trap with one was badly soiled and dead, though two

pouched young were still alive; she had apparently licked the toxic secretions.

## REPTILES

Reptiles were generally seen only during October to May, with one exception, see *Notechis curtus*.

### PYGOPODIDAE

#### *Aprasia* species

Eleven were trapped during November to April in dense heath. Three were dug up during earthworks in my garden. All were a uniform brown with no obvious striations, but their species was not determined. One trapped in November 1988 was identified by the Museum (WAM R100249) as *A. striolata*; subsequently four more were trapped in December.

#### *Pygopus lepidopodus* Scale-footed Lizard

A hatchling (70 mm) was seen on a track in May. Several road-kills were examined; also several individuals were seen alive in heath, occasionally climbing up vegetation, well camouflaged but more obviously seen where the vegetation was shorter. They generally preferred dense sedgy heath. Considerable variation in markings was noticed, from uniform brown to striped beautifully-coloured individuals.

### SCINCIDAE

#### *Ctenotus labillardieri*

Only one was trapped in the Park, but this species is common in Goode Beach. One specimen from The Gap is in the Museum (WAM 51761).

#### *Egernia kingii*

Only one was trapped in the Park, though several were seen in Goode Beach. One specimen from near Bald Head is in the Museum (WAM R25075).

#### *Egernia luctuosa*

Three were caught in Elliotts and one in a pit trap, all in dense sedgy heath.

#### *Egernia napoleonis*

One roadkill was collected (WAM R100324).

#### *Hemiernis peronii*

A specimen from The Gap (WAM R56101) is *Hemiernis p. peronii*.

#### *Tiliqua rugosa*

Five were caught in pit traps and 17 in Elliotts, all in more open heath; many were seen at all sites and on roads and firebreaks.

### VARANIDAE

#### *Varanus rosenbergi*

One was caught in a cat trap, and one had gone into a pit and killed a tiger snake *Notechis scutatus*. Individuals were seen occasionally on firebreaks in the Park or on the road.



## BOIDAE

### *Morelia spilota imbricata* Carpet Python

Two were removed from the houses in Goode Beach and released in the Park. Several were seen live or found dead on roads (WAM R98118).

## ELAPIDAE

### *Notechis coronatus* Crowned Snake

Four adults were trapped in spring and summer. Three hatchlings were trapped during February to May. Though only trapped in dense sedges, adults were occasionally seen on the roads or tracks early in the morning: One in October had half-swallowed a skink *Ctenotus catenifer* but disgorged it when disturbed. Six specimens from Frenchman Bay (near Goode Beach) are in the Museum (WAM 22483-8).

### *Notechis curtus* Bardick

During the summer this pugnacious little snake, though considered a nocturnal species, was frequently seen on the roads or firebreaks sunning during late afternoons; one was seen almost daily during June and early July on a firebreak in spite of very inclement wet weather. A dead specimen was disgorged by a mist-netted Kookaburra *Dacelo gigas* at Goode Beach (WAM R94801).

### *Notechis scutatus* Tiger Snake

Six were caught in pit traps: One in December had been killed by a monitor *Varanus rosenbergi* which went into the pit after it. Tiger snakes were much more frequently seen alive on firebreaks or as roadkills than the dugite *Pseudonaja affinis* within the Park boundaries.

### *Pseudonaja affinis* Dugite

Only two alive and two roadkills were seen in the Park but several roadkills and live ones were seen outside the park, in the vicinity of Little Grove.

## CONCLUSIONS

In spite of this small Park being under considerable tourist pressure, a surprising number of vertebrate species were recorded; most were found in the banksia-dominant central third of the Park, where there was a diversity of habitats. The winter-flowering *Banksia quercifolia* played an important role in the sustenance of the Honey Possum during the winter. The finding of the rare and endangered Dibbler was especially rewarding.

This healthy state should continue provided fires, habitat preservation and introduced predatory animals can be adequately controlled. Fires may always have been a problem, but some vertebrates undoubtedly survive on the numerous granite outcrops in the central third. Controlled burn-off areas were recolonised within a year by all except fossorial species or those requiring dense cover.

Urban development on the long northern boundary may accentuate two problems; illegal use of off-road vehicles, which erode the fragile sands, and increased numbers of feral cats. Sustained control of feral cats and foxes would be especially important after fire.

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## THE WATER-RAT, *HYDROMYS CHRYSOGASTER* (MURIDAE) ON DORRE ISLAND, W.A.

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During 1986 and 1987, four trips were made to White Beach on Dorre Island, Shark Bay, to carry out research into the ecology of the Western Barred Bandicoot (*Perameles bougainville*). We arrived at the beach on the last of these visits on 18 August 1987. On landing, we saw in the sand a number of tracks made by a medium-sized mammal other than those - previously recorded from the island *Lagorchestes hirsutus*, *Lagostrophus fasciatus*, *Bettongia lesueur* and *Perameles bougainville* (Ride and Tyndale-Biscoe 1962). Over the course of the previous visits we had become familiar with the tracks of the other mammals, but had not seen these particular prints before.

On 19 August, at about 2130H, one of us (NDT) was returning to our campsite on the beach when he saw in the light of his head-torch a water-rat (*Hydromys chrysogaster*) about 20 metres from the cliffs at the southern end of White Beach. On the following night at 0230H we both saw a water-rat (presumably the same individual) in virtually the same place. On both occasions, the animal was foraging along the strand-line in washed-up seagrass. Under observation by head-torch, it walked along the sand towards the cliffs, climbed onto the rocks at the cliff-base, then disappeared under a rock ledge. The water-rat was observed at a distance of 10-15 metres for at least 30 seconds on both nights, allowing us ample opportunity to note its distinctive features. These included its size, its gait, the shape of its head and the taper of the hind-quarters out to the base of the tail. The tail itself was covered with dark fur and bore an obvious white tip. The overall colour of the pelage appeared to be dark brown.

*Hydromys chrysogaster* is widespread in coastal and inland parts of northern and eastern Australia and in New Guinea and its adjacent islands, and is present in Western Australia in the north-west and the south-west (Olsen 1983). It has been recorded from Barrow Island (Butler 1970), the Montebello Islands (Butler 1970; Burbidge 1971) and Depuch Island (Ride 1964). This is the first record of the species on 1000 km of coastline - between Moore River and Barrow Island.

Our sighting of water-rat tracks on White Beach only on our fourth visit, despite close attention to mammal tracks on previous occasions, leads us to